U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 123.

RED CLOVER SEED:

INFORMATION FOR PURCHASERS.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY,
Washington, D. C., December 1, 1900.

SIR: I have the honor to transmit herewith, for publication as a Farmers' Bulletin, a manuscript by Mr. A. J. Pieters, assistant botanist in charge of pure-seed investigations, entitled, "Red Clover Seed: Information for Purchasers." In the progress of our investigations of the quality of commercial seeds we have learned that one of the most potent factors in encouraging the sale of poor seed is the desire of many farmers to secure a cheap article. This bulletin, which has been prepared for popular distribution, is intended to show that during the coming season purchasers are more likely than ever before to find poor and worthless clover seed for sale. The precautionary measures that are here advocated will prove a benefit not only to the farmer but also to the large number of reliable seedsmen who are conducting a legitimate business in high-grade seeds. It will be a mutual benefit to both parties if farmers can learn, by testing their seeds, on what dealers they can rely to furnish them a stock of good quality.

Respectfully,

FREDERICK V. COVILLE,
Botanist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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INFORMATION FOR PURCHASERS OF RED CLOVER SEED.

POINTS IN SELECTION OF CLOVER SEED.

Advancing price a warning of danger.—In March, 1900, the Department issued a circular on red clover seed in which attention was called to the probable continued advance in price, and consumers were warned against the purchase of low-priced seed. Events have fully justified the fear that with advancing price much seed of poor quality, as well as adulterated seed, would be offered. Reports coming from various sections of the United States show that a large amount of adulterated seed is offered, and that where buyers are not sufficiently careful or well informed much is actually sold. The clover-seed crop for 1900 has not been up to the average in either quantity or quality, especially in the States that furnish the higher grades. This has resulted in a further increase in price, and to-day really first-class red clover seed commands a higher price than it has for many years.

FIG. 1.—Red clover seed and a few of its impurities: *a*, dodder (*Cuscuta arvensis*); *b*, yellow trefoil (*Medicago lupulina*); *c*, red clover (*Trifolium pratense*); *d*, broad-leaved plantain (*Plantago rugelii*); *e*, buckhorn (*Plantago lanceolata*).

European as compared with American seed.—European dealers are offering seed in America, and, although much of this is doubtless American seed that was exported during times of low prices, it is possible that some seed of the European variety may find its way to America. Such seed has been offered to American importers this year, and under certain conditions of the market some may come to the United States.

The use of European clover seed would undoubtedly prove disappointing to the American farmer, since the plant seems to be ill adapted to the climate prevailing in the clover-growing sections of the United States.

The variety has not been extensively tried in America, owing to the high price the seed usually commands at home, but so far as trials have been made it is clearly unfit for planting in the latitude of Washington, D. C. Until further tests, at present planned by the Department, shall have been made, it will at least be unwise for American consumers to use European seed.

Determination of quality.—The quality of a sample of clover seed depends upon its cleanness, the percentage of germinable seed, the vigor of germination, and the origin of the seed. The cleanness of a sample depends both upon its freedom from broken seeds, dirt, and other inert matter, and upon the absence of weed seeds and the seeds of other cultivated plants. The seeds of timothy and of white and alsike clover are often present, and, although they must be considered impurities, they can not be called injurious. Timothy may sometimes be present in such quantity as to be objectionable, not from the nature of the plant, but because the seed can be purchased at a much less cost than clover seed, and a farmer does not want to pay for clover when he gets timothy. More serious is the presence of a considerable quantity of weed seeds, especially if among the lot are the seeds of some of the more pestiferous weeds. The accompanying illustration (fig. 1) shows the appearance of red clover seed and of some of its principal adulterants highly magnified.

In some localities low grades of clover seed are demanded because the clover is to be used as green manure, and it is thought that the weeds will furnish green material for plowing under and can thus do no harm. This is true to a certain extent, but the weeds fall far short of the clover as green manure, and the value of the sod will be reduced in proportion to the abundance of weeds.

It is poor economy to pay for weed seeds and to allow them to occupy the ground at a saving of 25 to 50 cents on the acre for seed. Moreover, when a sample of clover seed is very foul it nearly always contains large quantities of the seeds of the worst weeds, such as sorrel, buckhorn, plantain, and sometimes dodder. The seeds of dodder are, fortunately, not yet common in American clover seed, and are rare in well-cleaned, home-grown seed, but the danger of the spread of this pest should not be underrated. When it is realized that a dodder plant can attack one clover plant after another until it has destroyed the clover over an area of several square feet, it will be seen that not even one dodder seed in a pound of clover seed should be tolerated.

Grades.—Seedsmen are compelled to keep different grades of clover, as of other seed, to supply the demand for seeds of different prices. The difference in the grades is due to difference in quality, and as a rule the quality decreases more rapidly than the price. The quality of any lot of clover seed is either natural—that is, due to the condition

of the seed or of the field in respect to weeds or the thoroughness of cleaning—or it is artificial. In the latter case two or more lots of different grades have been mixed to produce a new grade of the desired quality, or the clover seed has been mixed with some adulterant, usually yellow trefoil or small-seeded Hungarian grass.

Mixing of seeds to produce grades.—Seedsmen distinguish the two methods of producing grades just mentioned as legitimate and illegitimate; even those seedsmen who knowingly sell adulterated seeds admit that such a course is not legitimate. On the other hand, mixing different grades is generally claimed by them to be proper, and, indeed, often necessary if the seedsman is to sell at a price his customers are willing to pay. Mixing seeds of a high grade with screenings clearly lowers its quality, and this is evident to anyone who carefully examines the sample, but they argue that no intentional deception is practiced, although the new grade may be well stocked with weed seeds. The seedsman who adds adulterants has, however, a different object in view. He wishes to lower the cost of the seed to himself without injuring its appearance. Such seed is usually sold at a trifle below the market price of the grade for which it is offered, and is an injury to the legitimate trade as well as a fraud on the buyer. Adulterated seed is commonly offered on sample, but is sold usually to those not sufficiently informed to detect the deception.

Adulterants.—The most frequent adulterant is yellow trefoil, a great deal of which has been imported into this country during the past year, some of it under the name of crimson clover. Most of this will doubtless be used to adulterate red clover seed, since the demand for trefoil seed is insignificant. The plant, although a legume, is objectionable in clover fields because it occupies ground that could be more profitably given to the clover plant and because it does not mature with the clover. The seed so closely resembles that of red clover that as much as 30 per cent can be mixed with the latter without being detected on casual examination. It is greenish yellow in color, and is distinguished by a minute projection in the neighborhood of the scar that marks the point of attachment of the seed in the fruit. Another adulterant sometimes used is the seed of Hungarian grass. The small seeds are used which in size closely approximate the clover. The dark color also readily blends with high-grade clover seed and enables the unscrupulous seller to offer apparently good qualities at prices with which honest dealers can not compete.

Germination of clover seed.—Low-grade seed usually contains a large amount of brown, dead seeds. These reduce the percentage of germination of the sample and consequently reduce its value. In order to use the right amount of seed for a good catch of clover it is necessary to know how much of the seed will grow. When 15 pounds are sown on an acre and only one-half of the seed sprouts, it is equivalent

to using only 7½ pounds of seed which is all good, and a correspondingly poor stand is inevitable. Not only should the percentage of germination be known, but the seed should germinate vigorously. Slow germination usually indicates weak seed, and such seed will produce weak plants. These seeds are generally light and are blown out in well-cleaned samples, but may be present in large amounts in low grades.

Testing clover seed.—The color and shape of red clover seed are so well known that a description is not necessary. Fresh seed is generally bright and plump in appearance and such is the most valuable. Samples that have a large admixture of dull, dark-brown seeds should

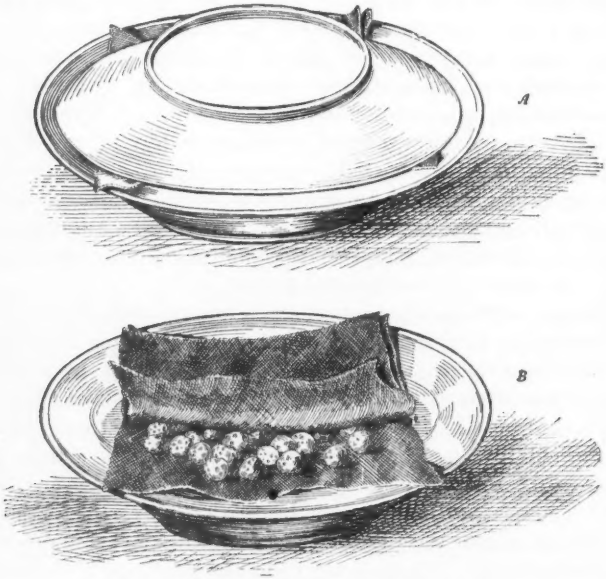

FIG. 2.—Simple germinating apparatus: *A*, closed; *B*, open.

be looked upon with suspicion, and should not be used unless testing shows them to be good.

It is not a difficult matter for anyone to test his clover seed for germination. A good germinator can be made with two dinner plates and a folded piece of flannel cloth (fig. 2). The seeds should be placed between the folds of the dampened cloth, which is then laid on one plate while the second plate is inverted over the first. When tests are made during the winter, the plates should be put in a warm place so that the temperature will not fall much below 50° at night and 60° to 70° during the day. Any other apparatus that will keep the seeds moist and warm while admitting air will serve equally well, or the seeds may be planted in a flowerpot or pan of earth. The sprouts

should be counted and removed from day to day until the conclusion of the test. If the seed is good and the conditions are right, red clover should begin sprouting vigorously the second or third day, and in four or five days nearly all the good seeds will have germinated. A few will come on later, and seed-testing establishments generally allow ten days as the limit for red clover. In case many seeds remain hard at the end of ten days it is fair to consider that one-third of them would grow after a reasonable time in the field.

Best seed to buy.—The prices charged for clover seed vary greatly, each large dealer having two or more grades, of different prices. Unfortunately for the buyer, each dealer has his own grade names, and even the standard terms, prime, choice, and fancy, as used by different dealers, do not always mean the same thing. If for these indefinite terms could be substituted a statement of the percentage of pure and germinable seed, the buyer could tell at once what sample was the most advantageous for him to buy. It is a safe general conclusion that the sample which, while reasonably free from weed seeds, contains the largest amount of pure and vigorously germinating clover at the least cost is the best one for the farmer to buy. Low-priced samples seldom fulfill this condition, nor do those sold at exorbitantly high prices. Usually the high grade, medium-priced samples are really the cheapest, but the only way to determine the value of a sample is to test the seed. The result of the purity test shows how much pure seed is present and the germination test determines how much of this pure seed will grow and how vigorously it will germinate.

Results of some tests.—During the past year (1900) a large number of tests have been made of seed offered by wholesale dealers. A few of these tests are given below to show that there is no close agreement between selling price and quality. The examples given have been divided into three groups, according to the market price of the seed. In the first group are the low-priced samples, below $4.50 per bushel; in the second group, those of medium price, between $4.50 and $5; in the third group, the high-priced lots, $6 or more. The three examples in each group are arranged in the order of the price really paid for a bushel of good seed. This may be called the calculated price. Of course, commercial seed never contains 100 per cent of pure and germinable seed, but this ideal standard is used as a measure of the real value of different qualities sold at different prices. The average number of weed seeds per pound of seed as sold is also given. In determining the number of weed seeds only seeds of such plants as are commonly considered weeds were counted. In comparing the market and calculated prices the number of weed seeds in some of the low-priced lots should not be overlooked. No. 9368 while showing the lowest calculated price, because of its extremely low market price, contains a large number of weed seeds, and the germination of this

sample was not vigorous; it should therefore be rejected. The quality of the high-priced samples was good, but the prices were much higher than the condition of the market would justify. For his own protection the farmer should ask for a statement of the percentage of pure and germinable seed in any lot he buys. The seedsman can readily ascertain this percentage and the buyer can verify the statement by sending a sample either to his State experiment station or to the United States Department of Agriculture.

Results of some tests of red clover seed made before 1900.

Test number.	Market price per bushel.	Per cent of pure and germinable seed.	Calculated price per bushel.	Number pounds good seed per bushel.	Number weed seeds per pound.
9368	3.00	63.21	4.74	37.92	*a* 20,928
9328	4.20	77.73	5.40	46.63	5,000
9327	3.45	53.26	6.48	31.95	*b* 27,000
9271	4.98	93.83	5.28	56.29	700
9276	4.80	83.66	5.73	50.19	4,600
9305	4.80	64.89	7.39	38.92	27,700
9461	6.00	95.80	6.24	57.48	1,540
9303	6.00	88.03	6.78	52.81	360
9463	7.20	80.10	9.00	48.00	225

a Weed seeds, mostly green foxtail. *b* Mostly green foxtail and plantain.

FIELD TESTS OF AMERICAN AND EUROPEAN CLOVERS.

Collection of seed.—As a preliminary to a more extensive study, red clover seed from American and European sources was planted in April, 1900, on the Department trial grounds on the Potomac Flats at Washington, D. C. The American samples were secured from the United States experiment stations or from private sources in the States of Ohio, Indiana, Illinois, New York, California, Kentucky, and Montana, besides some that were collected by Dr. C. W. Stiles, then scientific attaché at Berlin, from European dealers and represented as being from Ohio, Wisconsin, Canada, and "North America." European seed was secured from Dr. Stiles, and also through the Section of Seed and Plant Introduction of this Department. The samples were marked as follows: Hungarian, Russian, Transylvanian, Galician, French, Stiermark, Leitmeritz, English, and Italian. Thirty-five samples in all were planted, each on 1 square rod. One lot of Italian seed proved to be so poor that it was not used.

Sowing.—About an ounce and a half (42.6 grams) of pure and germinable seed was planted on each rod, the total amount used being often far in excess of this, owing to the poor quality of the seed. Thirty-one plats were planted April 27, two on the 28th, and two more on the 30th. By the 5th of May some plants were up on most of the plats, and on May 17 notes were taken on the relative condition of the stand. It will not be necessary to give these notes in detail, but

in general the stand at this stage was a little the better among the European varieties, although there was much difference in this respect between adjoining plats. Heavy rains that occurred during May had injured some of the plats, in some cases washing out a large portion of the surface.

Notes were taken at different times, and on June 21 the writer attempted to make an estimate of the condition of each plat expressed in percentage. Plat 1, which was good, with thrifty plants 3 to 6 inches high, was taken as 100, and the condition of the other plats was compared with it. At this time the average condition of the European plats was 85, as against 70.5 for the American. From this time on, however, there was a decided change.

Effect of summer heat.—The weather remained clear and hot, and by July 2 the relative position of the plats was reversed. All the European plats had suffered severely from the intense sunshine. Growth had ceased, many of the leaves were wholly dried up and burned and nearly all had their edges more or less browned. This condition was not due to drought, because the soil was moist at less than an inch below the surface. The American plats, on the other hand, showed no evidence of injury, but were higher and stronger than on June 21. The plants now averaged 4 to 9 inches high, and their thrifty, dark-green color contrasted pleasantly with the brown of the European plats, which could be picked out all over the field by the brown color alone. At this time the estimated condition of the European plats was 71 against 88 for the American, plat No. 2, now more representative, being taken as the standard.

Cuttings and yield.—On July 19 and 20 the plats were all cut and the green product weighed. At this time the American plats were in prime condition for hay, being in full bloom and about one-third of the blossoms brown. On the European plats there were only a few blooms borne on small, weakly stalks.

Special mention should be made of the fact that plats 1 to 6, inclusive, were on ground a few inches higher than the remainder of the ground, the whole tract sloping slightly toward the river. The plats planted here were undoubtedly at a disadvantage, but since four were American and only two European this worked no prejudice to the European seed.

The seed sold as English produced plants that were much nearer to the American type than to the European, and the yield on this plat was nearly twice the average yield on the other European plats. This plat also showed less injury from the sun than any other plat of European clover. These facts cast doubt on the origin of the seed, but the yield has been included in that of the European plats.

The American clovers recovered rapidly after cutting, and on August 2 the plants on many plats were already in bloom. On the

European plats there were no blooms, and the leaf growth progressed less rapidly than on the American plats. Reference to the table will show, however, that the European clovers gave a heavier yield at the September cutting than they did in July. The yield of the American plats was practically the same at both cuttings.

There were, of course, variations in the condition and in the yield among the different plats, both of European and of American origin, and in most cases such differences can not be accounted for by the difference in location or treatment. No doubt further experiments will show that the origin of clover seed is of great importance in determining the yield.

Tabular comparison.—In the table below are given the average yields of green clover per acre for American and European varieties as calculated from the actual yield of fifteen plats of American and twenty of European. If the six plats located on slightly higher ground are omitted, the total yield per acre for the American will be 14,784 pounds, and that for European 8,128 pounds.

Average yield of green clover per acre in pounds.

Varieties.	July.	September.	Total.
American clover	6,336	6,368	12,704
European clover	3,104	4,588	7,792

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to Senators, Representatives, and Delegates in Congress, or to the Secretary of Agriculture, Washington, D. C.:

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